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IMPLEMENTATION PLAN REVIEW FOR MISSOURI AS REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT

TRW/Environmental Services

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U. S. ENVIRONMENTAL PROTECTION AGENCY

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16. ABSTRACT

Section IV of the Energy Supply and Environmental Coordination Act of 1974, (ESECA) requires EPA to review each State Implementation Plan (SIP) to determine if revisions can be made to control regulations for stationary fuel combustion sources without interferring with the attainment and maintenance of the national ambient air quality standards. This document, which is also required by Section IV of ESECA, is EPA's report to the State indicating where regulations might be revised.

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IMPLEMENTATION PLAN REVIEW

FOR

MISSOURI

REQUIRED BY THE ENERGY SUPPLY AND ENVIRONMENTAL COORDINATION ACT

PREPARED BY THE FOLLOWING TASK FORCE:

U. S. Environmental Protection Agency, Region VII
1735 Baltimore Avenue
Kansas City, Missouri 64108

Environmental Services of TRW, Inc.
(Contract 68-02-1385)

U. S. Environmental Protection Agency
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

February 1975

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1.0 EXECUTIVE SUMMARY

The enclosed report is the U. S. Environmental Protection Agency's (EPA) response to Section IV of the Energy Supply and Environmental Coordination Act of 1974 (ESECA). Section IV requires EPA to review each State Implementation Plan (SIP) to determine if revisions can be made to control regulations for stationary fuel combustion sources without interfering with the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). In addition to requiring that EPA report to the State on whether control regulations might be revised, ESECA provides that EPA must approve or disapprove any revised regulations relating to fuel burning stationary sources within three months after they are submitted to EPA by the States. The States may, as in the Clean Air Act of 1970, initiate State Implementation Plan revisions; ESECA does not, however, require States to change any existing plan.

Congress has intended that this report provide the State with information on excessively restrictive control regulations. The intent of ESECA is that SIP's, wherever possible, be revised in the interest of conserving low sulfur fuels or converting sources which burn oil or natural gas to coal. EPA's objective in carrying out the SIP reviews, therefore, has been to try to establish if emissions from combustion sources may be increased. Where an indication can be found that emissions from certain fuel burning sources can be increased and still attain and maintain NAAQS, it may be plausible that fuel resource allocations can be altered for "clean fuel savings" in a manner consistent with both environmental and national energy needs.

In many respects, the ESECA SIP reviews parallel EPA's policy on clean fuels. The Clean Fuels Policy has consisted of reviewing implementation plans with regards to saving low sulfur fuels and, where the primary sulfur dioxide air quality standards were not exceeded, to encourage States to either defer compliance regulations or to revise the SO_2 emission regulations. The States have also been asked to discourage large scale shifts from coal to oil in cases where such shifts are not required for attainment and maintenance of the NAAQS.

To date, EPA's fuels policy has addressed only those States with the largest clean fuels saving potential. Several of these States have or are currently in the process of revising SO_2 regulations. These States are generally in the Eastern half of the United States. ESECA, however, extends the analysis of potentially over-restrictive regulations to all 55 States and territories. In addition, the current reviews address the attainment and maintenance of all the National Ambient Air Quality Standards.

There are, in general, three predominant reasons for the existence of overly restrictive emission limitations within the State Implementation Plans. These are 1) The use of the example region approach in developing State-wide air quality control strategies; 2) the existence of State Air Quality Standards which are more stringent than NAAQS; and 3) the "hot spots" in only part of an Air Quality Control Region (AQCR) which have been used as the basis for controlling the entire region. Since each of these situations affect many State plans and in some instances conflict with current national energy concerns, a review of the State Implementation Plans is a logical follow-up to EPA's initial appraisal of the SIP's conducted in 1972. At that time SIP's were approved by EPA if they demonstrated the attainment of NAAQS or more stringent state air quality standards. Also, at that time an acceptable method for formulating control strategies was the use of an example region for demonstrating the attainment of the standards.

The example region concept permitted a State to identify the most polluted air quality control region (AQCR) and adopt control regulations which would be adequate to attain the NAAQS in that region. In using an example region, it was assumed that NAAQS would be attained in the other AQCR's of the State if the control regulations were applied to similar sources. The problem with the use of an example region is that it can result in excessive controls, especially in the utilization of clean fuels, for areas of the State where sources would not otherwise contribute to NAAQS violations. For instance, a control strategy based on a particular region or source can result in a regulation requiring 1 percent sulfur oil to be burned state-wide where the use of 3 percent sulfur coal would be adequate to attain NAAQS in some locations.

EPA anticipates that a number of States will use the review findings to assist them in making the decision whether or not to revise portions of their State Implementation Plans. However, it is most important for those States which desire to submit a revised plan to recognize the review's limitations. The findings of this report are by no means conclusive and are neither intended nor adequate to be the sole basis for SIP revisions; they do, however, represent EPA's best judgment and effort in complying with the ESECA requirements. The time and resources which EPA has had to prepare the reports has not permitted the consideration of growth, economics, and control strategy tradeoffs. Also, there has been only limited dispersion modeling data available by which to address individual point source emissions. Where the modeling data for specific sources were found, however, they were used in the analysis.

The data upon which the reports' findings are based is the most currently available to the Federal Government.* However, EPA believes that the States possess the best information for developing revised plans. The States have the most up-to-date air quality and emissions data, a better feel for growth, and the fullest understanding for the complex problems facing them in the attainment and maintenance of air quality standards. Therefore, those States desiring to revise a plan are encouraged to verify and, in many instances, expand the modeling and monitoring data supporting EPA's findings. In developing a suitable plan, it is suggested that States select control strategies which place emissions for fuel combustion sources into perspective with all sources of emissions such as smelters or other industrial processes. States are encouraged to consider the overall impact which the potential relaxation of overly restrictive emissions regulations for combustion sources might have on their future control programs. This may include air quality maintenance, prevention of significant deterioration, increased TSP, NO_x, and HC emissions which occur in fuel switching, and other potential air pollution problems such as sulfates .

Although the enclosed analysis has attempted to address the attainment of all the NAAQS, most of the review has focused on total suspended particulate matter (TSP) and sulfur dioxide (SO_2) emissions. This is because stationary fuel combustion sources constitute the greatest source of SO_2 emission and are a major source of TSP emissions.

* except data currently being processed by EPA

Part of each State's review was organized to provide an analysis of the SO_2 and TSP emission tolerances within each of the various AQCR's. The regional emission tolerance estimate is, in many cases, EPA's only measure of the "over-cleaning" accomplished by a SIP. The tolerance assessments have been combined in Appendix B with other regional air quality "indicators" in an attempt to provide an evaluation of a region's candidacy for changing emission limitation regulations. In conjunction with the regional analysis, a summary of the State's fuel combustion sources (power plants, industrial sources, and area sources) has been carried out in Appendix C, D, and E.

- The State Implementation Plan for Missouri has been reviewed for the most prevalent causes of over-restrictive fuel combustion emission limiting regulations. The major findings of the review are:

  FOR PARTICULATES, THERE IS LITTLE INDICATION THAT EXISTING REGULATIONS FOR FUEL COMBUSTION SOURCES ARE OVERLY-RESTRICTIVE. FOR SULFUR DIOXIDE, THERE ARE INDICATIONS THAT EMISSION LIMITING REGULATIONS FOR VERY LARGE FUEL BURNING SOURCES MAY BE OVERLY-RESTRICTIVE.

  The Kansas City and St. Louis Metropolitan areas were originally evaluated separately by the State of Missouri. Kansas City was used as the example region for the three out-state Missouri AQCR's. Missouri also has adopted ambient air quality standards different from the Federal Standards.

- Suspended particulates appear to be a widespread problem in Missouri. Metro St. Louis has recently been proposed a maintenance area for suspended particulates. There are no indications that current fuel burning regulations are overly-restrictive in the Metropolitan areas of Kansas City and St. Louis, or in outstate Missouri. A limited amount of fuel switching could occur without particulate regulation changes. However, should all sources now burning natural gas, for example, switch to coal, more stringent emission limiting regulations would be necessary to meet TSP air quality standards.

- Missouri has direct fuel combustion regulations for SO_2 only in the Metropolitan St. Louis Area. Except in St. Louis, therefore, fuel switching is not hindered by SO_2 emissions regulations. Current air quality sampling data for St. Louis indicate high isolated SO_2 concentrations in the Missouri portion of the metropolitan area. However, sources of SO_2 other than power plants are in the immediate vicinity of these "hot spots." Since these sources are presently meeting existing emission regulations, there are strong indications that regulations affecting these sources must be tightened.

There are currently no indications that SO_2 emissions from power plants in the Missouri portion of the St. Louis area are causing violations of SO_2 air quality standards. In the context of ESECA, these regulations may be revised. With regard to power plants, should the State of Missouri decide to revise the current SO_2 emission limiting regulations, EPA strongly suggests that the changes be closely coordinated with the State of Illinois.

2.0 STATE IMPLEMENTATION PLAN REVIEW

2.1 SUMMARY

A revision of fuel combustion source emissions regulations will depend on many factors. For example:

- Does the State have air quality standards which are more stringent than NAAQS?
- Does the State have emission limitation regulations for control of (1) power plants, (2) industrial sources, (3) area sources?
- Did the State use an example region approach for demonstrating the attainment of NAAQS or more stringent State standards?
- Has the State not initiated action to modify combustion source emission regulations for fuel savings; i.e., under the Clean Fuels Policy?
- Are there proposed Air Quality Maintenance Areas?
- Are there indications of a sufficient number of monitoring sites within a region?
- Is there an expected 1975 attainment date for NAAQS?
- Based on (1973) air quality data, are there no reported violations of NAAQS?
- Based on (1973) air quality data, are there indications of a tolerance for increasing emissions?
- Are the total emissions from stationary fuel combustion sources proportionally lower than those of other sources?
- Must emission regulations be revised to accomplish significant fuel switching?
- Is there a significant clean fuels savings potential in the region?
- Do modeling results for specific fuel combustion sources show a potential for a regulation revision?

The following portion of this report is directed at answering these questions. An AQCR's potential for revising regulations increases when there are affirmative responses to the above.

The initial part of the SIP review report, Section 2 and Appendix A, was organized to provide the background and current situation information

for the State Implementation Plan. Section 3 and the remaining Appendices provide an AQCR analysis which helps establish the overall potential for revising regulations. Emission tolerance estimates have been combined in Appendix B with other regional air quality "indicators" in an attempt to provide an evaluation of a region's candidacy for revising emission limiting regulations. In conjunction with the regional analysis, a characterization of the State's fuel combustion sources (power plants, industrial sources, and area sources) has been carried out in Appendix C, D, and E. Finally, candidates from Appendix B are examined in Appendix F for adequacy or over-restrictiveness of emission regulations.

Based on an overall evaluation of EPA's current information, AQCR's have been classified as good, marginal, or poor candidates for regulation revisions. The following table summarizes the State Implementation Plan Review. The remaining portion of the report supports this summary with explanations.

2.2 AIR QUALITY SETTING - MISSOURI

Missouri has been divided into five (5) Air Quality Control Regions:

(1) AQCR 070 - Metro St. Louis Interstate
(2) AQCR 137 - Northern Missouri
(3) AQCR 138 - South Eastern Missouri
(4) AQCR 139 - South Western Missouri
(5) AQCR 094 - Metro Kansas City Interstate

2.2.1 State Ambient Air Quality Standards

Missouri's AQCR's are shown geographically in Figure A-1. Missouri has adopted ambient air quality standards different from the federal standards. Table A-3 shows that State SO_2 standard for Missouri are somewhat more strict than federal standards, although averaging time differences make comparison uncertain. For particulates, the State standards are identical to federal secondary standards, except for the less stringent standards set for St. Louis. (AQCR 070).

2.2.2 Suspended Particulate Air Quality - 1973

Table A-4 summarizes Missouri SAROAD data for suspended particulates in 1973. All five Missouri AQCR's appear to have adequate TSP monitoring. Suspended particulates seem to be a widespread problem throughout Missouri. Less

Missouri State Implementation Plan Review
(Summary)

"INDICATORS"	STATE		(Metro St. Louis) 070 AQCR		(Metro Kansas City) 094 AQCR		(North Missouri) 137 AQCR		(S.E. Missouri) 138 AQCR		(S. W. Missouri) 139 AQCR	
	TSP	SO_2	TSP	SO_2	TSP	SO_2	TSP	SO_2	TSP	SO_2	TSP	SO_2
• Does the State have air quality standards which are more stringent than NAAQS?			NO	NO	NO	YES	NO	YES	NO	YES	NO	YES
• Does the State have emission limiting regulations for control of:												
1. Power plants			YES	YES	YES	NO	YES	NO	YES	NO	YES	NO
2. Industrial sources			YES	YES	YES	NO	YES	NO	YES	NO	YES	NO
3. Area sources			YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
• Did the State use an example region approach for demonstrating the attainment of NAAQS or more stringent State standards?	YES	YES										
• Has the State not initiated action to modify combustion source emission regulations for fuel savings, i.e., under the Clean Fuels Policy?	YES	YES										
• Are there proposed Air Quality Maintenance Areas?			YES	NO	NO	NO	NO	NO	NO	NO	NO	NO
• Are there indications of a sufficient number of monitoring sites within a region? (1)			YES	YES	YES	NO	YES	NO	YES	NO	YES	NO
• Is there an expected 1975 attainment date for NAAQS?	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
• Based on reported (1973) Air Quality Data, does air quality meet NAAQS?			NO	NO	NO	YES	NO	YES	NO	YES	NO	YES
• Based on reported (1973) Air Quality Data, are there indications of a tolerance for increasing emissions?			NO	NO	NO	YES	NO	YES	NO	YES	NO	YES
• Are the total emissions from stationary fuel combustion sources lower than those of other sources?			YES	NO	YES	NO	NO	NO	YES	YES	YES	NO
• Do modeling results for specific fuel combustion sources show a potential for a regulation revision?	◄—— NO MODELING RESULTS AVAILABLE FOR MISSOURI SOURCES[4] ——►											
• Must emission regulations be revised to accommodate significant fuel switching?			NO	YES	NO	NO	YES	NO	NO	NO	NO	NO
• Based on the above indicators, what is the potential for revising fuel combustion source emission limiting regulations?			POOR	MARGINAL[2]	POOR	N/A[3]	POOR	N/A[3]	POOR	N/A[3]	POOR	N/A[3]
• Is there a significant Clean Fuels Saving potential in the region?				NO		YES		YES		YES		YES

(1) Only an analysis tool and is not indicative of SIP Requirements.
(2) See Section 3.1.5.
(3) No applicable SO_2 regulation which could be revised
(4) See Section 3.1.5

NORTHERN MISSOURI INTRASTATE (137)
METROPOLITAN KANSAS CITY INTERSTATE (KANSAS-MISSOURI) (094)
METROPOLITAN ST. LOUIS INTERSTATE (ILLINOIS-MISSOURI) (070)
SOUTHWEST MISSOURI INTRASTATE (139)
SOUTHEAST MISSOURI INTRASTATE (138)

MISSOURI AQCR's

urbanized Northern and Southern Missouri mainly have problems relative to the short term standard, while Metro Kansas City and Metro St. Louis report around half of stations violating the secondary annual TSP standard in addition to many violations of the secondary 24 hour standard. The AQCR's 137, 138 and 139 appear to have more localized TSP problems than the Metropolitan AQCR's 070 and 094.

2.2.3 SO_2 Air Quality - 1973

The only 1973 violation of Federal ambient air quality standards appeared in the St. Louis AQCR (Table A-5). The first page of Table A-5 lists SAROAD data for 1973. Additional SO_2 air monitoring data for Metro St. Louis (AQCR 070) is shown on the second page of Table A-5. AQCR 070 seems to have annual average SO_2 levels at around 50 $\mu g/m^3$ at several locations. Two stations in Missouri and two in Illinois appear to have SO_2 levels above 70 $\mu g/m^3$, with one St. Louis station indicating an annual average of 118 $\mu g/m^3$.

2.3 MISSOURI EMISSIONS - 1972 NEDS INVENTORY

Although individual source emissions from more recent NEDS data was available for this report, the tables in Appendix A and the discussion below refer to 1972 NEDS data. This was mainly for convenience and simplicity. Table C, D and E reflect more recent emissions information, however.

2.3.1 Particulates

Fuel combustion accounts for about a third of reported particulate emissions in Missouri (Table A-7). Particulate emissions from power plants dominate the particulate inventory only in Kansas City (094). In St. Louis, industrial and area source emissions are important contributors, while area sources account for the largest fraction of emissions in outstate Missouri (AQCR 137, 138, and 139). The 1972 NEDS particulate inventory shows the Illinois portion of St. Louis (AQCR 070) to contribute most of the reported emissions. The NEDS indicates that Kansas and Missouri sources contribute about equally to particulate emissions in AQCR 094 (Metro Kansas City).

2.3.2 Sulfur Dioxide

Table A-8 shows that reported SO_2 emissions originate largely from fuel combustion in Missouri, and the largest fraction of SO_2 in the fuel combustion

category is from power plants. 1972 reported SO_2 emissions originating in the Illinois portion of AQCR 070 (St. Louis) are higher than those originating in Missouri, especially from power plants. In Metro Kansas City, SO_2 emissions are largely from power plants; the Missouri portion of AQCR 138 has only one power plant and no reported industrial SO_2 emissions (1972).

2.4 BACKGROUND ON MISSOURI SIP

Table A-1 lists the original priorities for SO_2 and particulates for Missouri AQCR's. Metro St. Louis (070), Metro Kansas City (094), and Northern Missouri were Priority I for particulates. All Missouri AQCR's but St. Louis were Priority III for SO_2, St. Louis being Priority I.

2.4.1 Particulates

The Metro Kansas Ctiy Interstate Region (AQCR 094) was used as the particulate example region for Missouri, except for St. Louis (AQCR 070). Particulate emissions regulations are not the same for 094 and outstate Missouri, however (see Table A-11). An Air Quality Display type model was used to demonstrate attainment of the secondary federal particulate standards in both Kansas City and in St. Louis. In addition to the regulations for large particulate emission sources in St. Louis (Table A-11), the SIP indicated that area source particulate controls would be instituted.

2.4.2 SO_2

SO_2 was Priority I only in St. Louis and attainment of federal ambient air quality standards was demonstrated using an AQDM type model. Both point and area source SO_2 emission controls were adopted (Table A-11) for St. Louis.

No SO_2 regulations were adopted for Missouri's other AQCR's. In the SIP, Kansas City was used as an example region to show that source growth would not cause SO_2 problems, with clean fuels being an inherent assumption in this projection.

2.4.3 Oxidant and NO_2

Both Kansas City (094) and St. Louis had oxidant violations at the time the SIP was written. The Federal Motor Vehicle Control Program was shown to be adequate for attainment of the oxidant standard without additional hydrocarbon controls.

Although St. Louis was originally Priority I for NO_2, AQCR 070 has since been reclassified to Priority III, and no NO_x controls have been instituted in Missouri.

3.0 AQCR ASSESSMENTS BASED ON SIP REVIEW AND CURRENT AIR QUALITY

The purpose of this Section is to examine fuel switching in Missouri's five AQCR's for over-restrictiveness of current emission regulations for attaining and/or maintaining ambient air quality standards. Tables A-9 and A-10 are an attempt to assign a regional emissions tolerance for Missouri AQCR's. Appendix B uses this "tolerance", along with such factors as the breadth and depth of air quality violations and percent of emissions resulting from fuel combustion to rate each AQCR as a "good", "marginal," or "poor" candidate for fuel switching potential and regulation relaxation.

Power plants, industrial sources, and area sources are investigated in Appendices C, D, and E respectively for fuel use, emissions, and current regulations. Some calculations of emissions resulting from fuel switching are included for power plants. Appendix F is a rough emissions inventory which could hypothetically result if all fuel burning sources emitted exactly at regulation levels. This inventory is the final test of current regulations relative to air quality.

Although each AQCR is treated separately in the appendices, Missouri's outstate AQCR's are lumped together in this section because their situation is similar and thus final conclusions concerning regulations are similar.

3.1 AQCR 070 - METRO ST. LOUIS INTERSTATE

3.1.1 Candidacy Assessment for Fuel Switch Potential - Particulates

AQCR 070 shows several violations of TSP standard both in Missouri and in Illinois. Although 1972 NEDS data reported Illinois particulate emissions to be much larger than those from Missouri, the sample air quality maintenance plan for St. Louis[13] shows expected 1975 particulate emissions to be of similar magnitude between the two states (Table A-9). AQCR 070 is assigned a zero increased particulate emissions tolerance in Table A-9 since the data do not indicate that emissions will be "over controlled" relative to attainment of NAAQS. Further, both Illinois and Missouri counties have been proposed as maintenance areas for TSP. Thus AQCR 070 receives a poor candidacy rating in Table B-1 for particulate regulation revision and fuel switch potential.

3.1.2 Candidacy Assessment for Fuel Switch Potential - SO_2

In Table A-10, the worst station SO_2 air quality reading in 1973 was applied to the 1972 NEDS inventory for AQCR 070, and the allowable emissions distributed between Missouri and Illinois in proportion to existing emissions. The NEDS 1972 inventory does not appear comparable to the 1975 estimated from the sample air quality maintenance plan for St. Louis. New power plant emissions may account for some of the difference of relative emission contributions from Illinois and Missouri. It should be commented that SO_2 levels elsewhere in Metro St. Louis are lower than the level used to calculate "allowable emission" in Table A-10, and the 118 $\mu g/m^3$ annual average SO_2 concentration represents a "hot spot". The approach in this report is a regional one and the numbers merely reflect the data base; the regional assumption about the air quality emissions relationship and the proportional allocation of "allowable" emissions between Missouri and Illinois.

Although total SO_2 emissions in AQCR 070 for 1975 appear lower than those in the 1972 NEDS, the tonnage is larger than the calculated "allowable" emissions. It is uncertain how comparable the two emissions inventories really are. AQCR 070 is assigned a zero tolerance for increased SO_2 emissions, and rated as a poor candidate in Table B-2 for fuel switch potential from an SO_2 standpoint.

3.1.3 Emission Source Examination

Missouri power plants in AQCR 070 use predominately coal at present (Table C-1). The three large power plants (Sioux, Labadie, and Meramac) are using coal of higher sulfur content than allowed by existing regulations (without stack gas SO_2 removal). Table C-2 indicates aggregated SO_2 emissions to be about twice the amount which existing regulations would allow. Particulates are generally controlled to below the amounts which regulations would allow. Power plant "fuel switching" possibilities in AQCR 070 are mainly limited to the use of higher sulfur coal.

Industrial emission sources (Table D-1) in AQCR 070 (Missouri) use coal for around one third of their gross heat input. Coal currently used would have, if used alone, more sulfur than allowed by existing regulations. Aggregated SO_2 emissions (Table D-2) are slightly below allowed emissions, however, so that individual users may be able to increase coal under existing regulations. Aggregated industrial particulate emissions are indicated to be more than the

amount regulations would allow. Industrial fuel switching in St. Louis would require lower sulfur coal than is currently used and more particulate emission controls to meet existing regulations.

Area sources in AQCR 070 (Table E-2) are subject to SO_2 and particulate emission limitation by virtue of sulfur and ash requirements for coal used (winter months only). Coal in the NEDS inventory for St. Louis area sources was reported higher in sulfur than regulations would allow. Since only a small portion of total heat input by area sources is supplied by coal, some additional coal could in principle, be used, although the ability of many small sources to convert to coal is not known. It might be commented from Table E-2 that increased SO_2 and particulate emissions would result from gas and oil conversions to coal even under existing regulations.

3.1.4 Regulation Examination - Particulates

Table F-1 is a rough emissions inventory for the Missouri portion of AQCR 070, showing present emissions and those which might result if all sources were allowed to emit according to regulations. Although the expected degree of control for non-fuel particulate sources is not known, particulate regulations do not appear over-restrictive in Missouri, regardless of the manner in which "allowable" emissions are distributed between Missouri and Illinois. Considering that St. Louis has been proposed as a maintenance area for particulates and that no source growth was considered in Appendix F, fuel burning particulate emission regulations should not be relaxed if air quality is to be attained and maintained.

3.1.5 Regulation Examination - SO_2

Table F-2 evaluates the effect of regulation compliance on total SO_2 emissions from Missouri sources in AQCR 070. The rough emissions analysis indicates that existing fuel burning SO_2 regulations applied to existing sources results in a Missouri SO_2 emissions total about equal to the "allowable" emissions assigned to Missouri from Table A-10 (based on worst case air quality in the region). On a regional basis, this suggests that SO_2 regulations are not overly restrictive in St. Louis. Close agreement of the "emissions at regulations" column (Table F-2) and the "estimated allowable" column is not intended to imply any particular accuracy to Table F-2.

However, modeling studies were conducted to predict the relationship between power plant SO_2 emissions and ambient air concentrations. The modeling results indicated that the SO_2 emissions from power plants located in Missouri were not responsible for the reported ambient air quality violations in downtown St. Louis. Local SO_2 emissions from smaller industrial fuel combustion sources were apparently the cause of NAAQS violations. Thus, there is some tolerance for an increase in SO_2 emissions from the existing Missouri power plants in AQCR 070. On the other hand, SO_2 emissions from small fuel combustion sources in the area of the "hot spot" must be reduced to attain the standards.

3.2 AQCR 094 - METRO KANSAS CITY INTERSTATE

3.2.1 Candidacy Assessment for Fuel Switch Potential

AQCR 094 shows several violations of TSP standards, both in Kansas and in Missouri with the highest concentrations being indicated in Kansas (Table A-4). Particulate emissions are about evenly distributed between the two states (Table A-8), although a much smaller fraction of total particulate emissions results from fuel combustion in Kansas than in Missouri. The original Kansas and Missouri SIP's gave no indication that particulate regulations would more than meet air quality standards in AQCR 094. Therefore, Metro Kansas City is rated as a bad candidate for fuel switching and regulation relaxation from a particulates standpoint.

SO_2 levels are slightly below ambient air quality standards in 094 (Metro Kansas City), with somewhat higher readings in Kansas than in Missouri (Table A-5). As might be expected, most of the SO_2 results from fuel combustion in 094, expecially in Missouri (Table A-7). The Missouri contribution of total SO_2 emissions is much higher than that of Kansas. AQCR 094 is assigned an approximate 45,000 ton regionwide tolerance for increased SO_2 emissions, based on a 22% rollup of air quality levels to standards. Table A-10 distributes this tolerance between Missouri and Kansas, in proportion to existing emissions. Table B-2 rates AQCR 094 as a good initial candidate for fuel switching.

3.2.2 Emission Source Examination

Coal is the dominant fuel for electric power generation in the Missouri portion of AQCR 094 (Tables C-1 and C-2). Power plants in the Kansas portion, in contrast, use mostly natural gas. According to NEDS information, aggregated particulate emissions are larger than the amount allowed by regulations in the Missouri portion of AQCR 094. No direct sulfur regulation applies to power plants (or other fuel burning sources). The reported sulfur in coal used by 094 power plants varies from 1.5 to 3.7%.

No coal is reportedly used by major emission sources in the Missouri portion of AQCR 094 (Table D-1). Consequently, particulate emissions are generally below regulations (Table D-2).

Table E-1 shows that Missouri area sources use only small amounts of coal compared to Kansas area sources in AQCR 094. Still, coal is a minor area source fuel on a total energy basis in AQCR 094 (Table E-2). Although a few area sources would be governed by particulate emission regulations in Kansas City, many are too small to be covered. The large natural gas use at present, implies that, even if emission regulations were to apply to area sources, total SO_2 and particulate emission increases would accompany almost any gas to coal switching. The extent to which fuel conversions by industrial and area sources is feasible is unknown at this time.

3.2.3 Regulation Examination - Particulates

Table F-1 shows the calculated particulate emissions which might result if all sources were to exactly meet existing fuel burning regulations. In the Kansas portion of 094, total particulate emissions could increase without violation of existing regulations. In Missouri, total particulate emissions would decrease as power plants meet the regulations. Note that uncontrolled non-fuel particulate emissions dominate the inventory in both Kansas and Missouri. Despite either a) the degree of control one might assume for non-fuel sources, or b) the manner in which "allowable" emissions might be distributed between Kansas and Missouri, fuel burning particulate emission regulations could not be judged overly restrictive by the simple test of Appendix F.

3.2.4 Regulation Examination - SO_2

No direct SO_2 emission regulation applies to fuel burning sources in the Missouri portion of AQCR 094. In Kansas (094), where an SO_2 regulation

has been adopted, additional emissions could occur from fuel switching within the Kansas regulation. The emissions comparison in Table F-2 indicates that additional SO_2 emissions might occur in the Missouri portion of AQCR 094 without air quality violations.

3.3 OUTSTATE MISSOURI AQCRs 137, 138, and 139

3.3.1 Candidacy Assessment - Particulates

Table A-4 indicates particulates to be a localized problem in outstate Missouri. Kansas City was considered the particulate example region for Missouri (other than St. Louis), although current regulations are not those which apply in Kansas City. Since there is no indication of overcontrol of particulates in outstate Missouri, either from the SIP or from recent data, a zero increased particulate emissions tolerance is assigned to outstate Missouri in Table A-9. Table B-1 rates the AQCRs 137, 138, and 139 as poor candidates for the switch potential.

3.3.2 Candidacy Assessment - SO_2

Scanty SO_2 monitoring data in outstate Missouri makes generalizations difficult. No SO_2 ambient air quality violations are reported. As far as fuel switching, no direct SO_2 fuel burning emission regulations apply, so that Table B-2 rates the outstate AQCRs as good potentials for fuel switching from an SO_2 standpoint.

3.3.3 Emission Source Examination

Although coal currently dominates electric power production in outstate Missouri, some additional coal might be substituted for natural gas (Table C-1). Many of the power plants have some particulate emission controls at present, so that aggregated particulate emissions are not dramatically above the allowed emissions (Table C-2).

Industrial sources in AQCR 137 would appear to have some gas to coal fuel switch potential (Table D-1). Although existing particulate emissions are not greatly above those allowed by regulations, further particulate controls would be necessary to meet existing regulations if additional coal was to be used by this industrial sector. AQCR 139 has no reported industrial coal use at present.

Table E-1 lists area source fuel use in outstate Missouri. Natural gas is seen to dominate the total. Little is known about the ability of area sources to switch fuels, but particulate regulations generally apply only to larger sources and hence may not be a major factor in fuel conversions.

3.3.4 Regulation Evaluation

Although regional aggregation of emissions has doubtful meaning in outstate Missouri, Table F-1 indicates that emissions resulting from all sources just meeting the particulate regulations would exceed the tonnage estimated from rollback (proportional to worst case air quality). To the extent that the regional approach is valid, there is no indication of over-restrictive particulate regulations in outstate Missouri.

No direct SO_2 emission regulations apply to outstate Missouri, and no regulation test was used in Table F-2 for outstate Missouri.

APPENDIX A

- State implementation plan information
- Current air quality information
- Current emissions information

Tables in this appendix summarize original and modified state implementation plan information, including original priority classifications, attainment dates, ambient air quality standards, and fuel combustion emission regulations. SAROAD data for SO_2 and TSP monitoring stations are shown for AQCRs in the state. NEDS emissions data by AQCR[1] are tabulated and broken down into fuel burning categories.

Tables A-9 and A-10 show a comparison of emission inventories in the original SIP and those from the NEDS. An emission tolerance, or emission tonnage which might be allowed in the AQCR and still not violate national secondary ambient air quality standards, is shown for SO_2 and particulates. The intent of this calculation is to indicate possible candidate regions for fuel switching. Tolerance was based on either the degree of control expected by the SIP or upon air quality/emission relationships which are calculated from more recent data. The value of the emission tolerance provides an indication of the degree of potential an AQCR possesses for fuel revisions and regulation relaxation.

Methodology for Increased Emissions Tolerance

A tolerance for increased emissions was determined as follows. First, an "allowable emissions" was calculated for each AQCR based on the current NEDS data and the percent reduction (or increase) required to meet the national secondary ambient air quality standards in that AQCR (worst case from Tables A-4 and A-5). This "allowable" was then compared to that from the SIP. If reasonable agreement occurred, then the "estimated emissions" which would result after implementation of the SIP in that AQCR was used to calculate an emissions tolerance. Thus, some credit could be given to an AQCR which might be restricting emissions more than required by ambient air quality standards. For instance, emission controls applied to AQCRs

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[1] "1972 National Emissions Report," EPA - 450/2-74-012, June 1974.

other than the example region for the state may reduce emissions well below "allowables." In the event that no data existed or was available from the SIP for an AQCR, the current air quality was used to assign emissions tolerance based on proportional rollback or rollup. Current air quality was also the criteria, if emissions data from SIP and NEDS did not appear to be comparable (this is often the case).

When no SIP emissions data was available, and current air quality levels were less than one half of the level represented by an ambient air quality standard, no "rollup" emissions tolerance was calculated in Tables A-9 and A-10. This arbitrary cutoff point was chosen so as not to distort the emissions tolerance for an area. At low levels of a pollutant, the relationship between emissions and air quality is probably not linear. Although this cutoff may leave some AQCRs with no quantifiable emissions tolerance, it was felt that no number at all would be preferable to a bad or misleading number.

It is emphasized that emissions tolerance is a region-wide calculation. This tolerance obviously makes more sense in, say, an urban AQCR with many closely spaced emissions sources than in a largely rural AQCR with geographically dispursed emissions.

A word of caution regarding particulates needs mentioning. Emission source estimates in the NEDS data bank and most state SIP's are for total particulates. Generally, the control strategies for particulates are aimed at total particulates, while the high-volume particulate sampling (SAROAD data) measures only the finer, suspended fraction. A given level of total particulate emissions control will therefore not translate into the same level of measured ambient air quality. Some of the larger particulates being controlled will not remain suspended, and therefore would not be measured by the High-volume technique. Hence, particulate control plans may have underestimated the amount of control necessary to achieve ambient air quality standards.

NORTHERN MISSOURI INTRASTATE (137)
METROPOLITAN KANSAS CITY INTERSTATE (KANSAS-MISSOURI) (094)
METROPOLITAN ST. LOUIS INTERSTATE (ILLINOIS-MISSOURI) (070)
SOUTHWEST MISSOURI INTRASTATE (139)
SOUTHEAST MISSOURI INTRASTATE (138)

MISSOURI AQCR's

Figure A-1. Missouri AQCR's

Table A-1. AQCR Priority Classification and AQMA

AQCR	Reg. #	Part.[b]	SO_x[a]	NO_x[c]	Demographic Information			Proposed AQMA Designations[d]		
					Population 1970	Square Miles	Population Density	TSP Counties	SO_x Counties	O_x Counties
Metro St. Louis	070	1	1	III				Yes	No	Yes
Missouri					1,827,681	2713	674	4[e]	0	4
Illinois					642,450	3758	171	3	3	3
N. Missouri	137	1	III	III	647,653	24182	27	None	None	None
S.E.Missouri	138	II	III	III	451,147	14486	31	None	None	None
S.W.Missouri	139	III	III	III	797,565	24502	33	None	None	None
Metro Kansas City	094	I	III	III						
Missouri					953,923	3117	306	None	None	None
Kansas					460,258	1094	421	None	None	None

Criteria Based on Maximum Measured (or Estimated) Pollution Concentration in Area

Priority	I	II	III
	Greater than	From - To	Less than
[a]Sulfur oxide:			
Annual arithmetic mean . .	100	60-100	60
24-hour maximum.	455	260-455	260
[b]Particulate Matter:			
Annual Geometric Mean . . .	95	60-95	60
24-hour maximum	325	150-325	150
[c]Nitrogen dioxide	110		110

[d]Federal Register, August, 1974 SMSA's showing potential for NAAWS violations due to growth

[e]Includes St. Louis City

Table A-2. Attainment Dates

AQCR #	AQCR Name	Particulates Attainment Dates		Sulfur Dioxide Attainment Dates		Nitrogen Oxides Attainment Dates
		Primary	Secondary	Primary	Secondary	
070	Metro St. Louis	7/75	7/75	7/75	7/75	a
137	N. Missouri	7/75	7/75	a	a	a
138	S. E. Missouri	7/75	7/75	a	a	a
139	S. W. Missouri	a	a	a	a	a
094	Metro Kansas City	7/75	7/75	a	a	a

[a] Already Below Federal Standards

Table A-3. Ambient Air Quality Standards - Missouri (Expressed as $\mu g/m^3$)

		Total Suspended Particulate		Sulfur Oxides			Nitrogen Dioxide
		Annual	24-Hr.	Annual	24-Hr.	3-Hr.	
Federal	Primary	75(G)	260[a]	80(A)	365[a]		100(A)
	Secondary	60(G)	150[a]			3100[a]	100(A)
						1 Hour	
State	St. Louis	75(G)	200[b]	---	---	---	---
	Kansas City	60	150	40(G)	200[b]	933	---
	All Outstate AQCRs	60	150	40	160[b]	667	---

(A) Arithmetic Mean
(G) Geometric Mean
a Not to be exceeded more than once per year
b Not to be exceeded more than one day in 3 month period

Table A-4. Missouri AQCR Air Quality Status (1973), TSP[g]

AQCR Name	AQCR #	# Stations Reporting	TSP Concentration ($\mu g/m^3$) Highest Reading Annual	TSP Concentration ($\mu g/m^3$) Highest Reading 24-Hr.	TSP Concentration ($\mu g/m^3$) 2nd Highest Reading 24-Hr	# Stations Exceeding Ambient Air Quality Standards: Primary Annual	Primary 24-Hr.	Secondary Annual	Secondary %	Secondary 24-Hr.	Secondary %	% Reduction Required to Meet Annual Secondary Standard	% Reduction Required to Meet 2nd 24-Hr. Standard
Metro St. Louis	070												
Missouri		28	116	484	326	6	1	14	50	10	36	83[a]	54[d]
Illinois		1	---	202	172	-	0	--	--	1	--	---	13
		29				6	1	14	50	11	36	83	54
N. Missouri	137	9	109	323	289	1	1	1	11	2	18	59[c]	48
S. E. Missouri	138	10	50	878	580	0	2	0	0	3	33	0	74
S. W. Missouri	139	13	54	312	179	-[f]	0	0	0	3	23	0[f]	16
Metro Kansas City	094												
Missouri		19	77[e]	440	254	1[e]	0	1[e]	--	12	63	[e]	41
Kansas		14	128	479	442	6	4	7	50	9	64	85	66
		33				7	4	8	--	21	63	85	66

a Background Missouri 070 & 094 = 48.5

b Background Illinois 070 = 40

c Background AQCR's 137,138,139 = 26

d No Background assumed on 24 hour levels

e Insufficient data for annual geometric mean in most Missouri States in AQCR 094

f Only one station unit sufficient data for geometric mean in AQCR 139

g In SAROAD Data Bank, June 1974

h 2nd Highest 24 hour reading

Table A-5. Missouri AQCR Air Quality Status (1973), SO_2

AQCR Name	AQCR #	# Stations[a] Reporting 24-Hr. (Dubbler)	# Stations[a] Reporting (Contin.)	SO_2 Concentration $\mu g/m^3$ Highest Reading			# Stations Exceeding Ambient Air Quality Std.			Concentration Equated To Most Primary 24-Hr. Standard[b]
				Annual	1st 24-Hr.	2nd 24-Hr.	Primary Annual	Primary 24-Hr.	Secondary 3-Hr	
Metro St. Louis	070									
Missouri		4	8	49	487	250	0	0	N/A	-22
Illinois		0	4	--	---	---	-	-	N/A	---
			12							
N. Missouri	137	0	0	--	---	---	-	-	---	---
S. E. Missouri	138	0	5		217		-	-	---	-68
S. W. Missouri	139	4	0	--	26	24	0	0	0	---
Metro Kansas City	094									
Missouri		5	2	N/A	251	129	0	0		-45
Kansas		7	4	28	326	300				-22
		12								-22

[a] SAROAD Data Bank, June 1974

[b] Based on 1st High Reading

Table A-5. (Continued) Missouri AQCR Air Quality Status (1973), SO_2 (1)

AQCR 070 SO_2 Levels St. Louis Area 1973 ($\mu g/M^3$)

MONITORING SITE	ANN. ARITH. MEAN	MAX. 3 HR. AUG.	MAX. 24 HR. AV.	% Reduction To Annual STD
MISSOURI SITES (AQCR 070)				
Linferry & Lindberg	50	667	155	
Route 67 & I-270	50	613	251	
55 Hunter Avenue	45	560	211	
St. Charles Rock Rd.	45	1253	507	
215 South 12th	77	667	256	
305 Weidman Road	35	773	227	
Chain of Rocks Water Department	52	---	---	
River Des Peres 1 Sulfer Avenue	48	---	---	
Shreve & I-70	55	---	---	
8227 S. Broadway	118	N.A.	N.A.	+ 32
ILLINOIS SITES (AQCR 070)				
Granite City	27	---		
Cahokia Downs	29	---		
316 N. 8th-East E.St. Louis Fed. Bldg.	72	---		
Wood River	72	1867(373)*	720	

(1) Source: Region VII EPA

* 2nd highest 3 hour reading

Table A-6. Fuel Combustion Source Summary

AQCR Name	AQCR #	Power Plants		Other Fuel Combustion Point Sour	
		NEDS[a]	FPC[b]	Particulate	SO_2
Metro St. Louis (Missouri Only)	070	4	4	10	9
North Missouri	137	4	1	15	15
South East Missouri	138	0	1	1	1
South West Missouri	139	3	3	3	1
Metro Kansas City	094	9	10	15	15
Missouri		2	3	3	3
Kansas					

a) NEDS Data Bank, June 1974

b) Federal power commission listings obtained from EPA data bank

Table A-7. Missouri Emissions Summary, Particulates

AQCR	Total (10^3 Tons/Year)	Percent Fuel Combustion	Electricity Generation		Point Source Fuel Combustion		Area Source Fuel Combustion	
			(10^3 Tons/Year)	%	(10^3 Tons/Year)	%	(10^3 Tons/Year)	%
070 (St. Louis)								
Missouri	44	57	4.1	9.3	5.5	13	15.5	35
Illinois	310	22	43.1	14	12.2	3.9	8.4	2.7
	354	32	47.5	13.4	17.7	5.0	23.9	6.8
137	64	66	9.0	14	4.7	7.0	28.8	45
138	25.5	39	0	0	0	.63	9.9	39
139	53.3	40	1.8	3.4	.03	.06	19.6	37
094								
Metro Kansas City								
Missouri	35.7	55	16.8	47	1.78	5.0	1.1	3.0
Kansas	42.2	15	0.625	1.5	.054	.1	5.8	14
	77.9	34	17.5	22	1.8	2.3	6.9	8.9

Table A-8. Missouri Emissions Summary, SO_2

AQCR	Total (10^3 Tons/Year)	Percent Fuel Combustion	Electricity Generation		Point Source Fuel Combustion		Area Source Fuel Combustion	
			(10^3 Tons/Year)	%	(10^3 Tons/Year)	%	(10^3 Tons/Year)	%
070								
Missouri	514	72	333	65	18	3.5	18.5	3.5
Illinois	720	93	607	84	41	5.6	20.3	2.7
	1234	84	940	76	59	4.7	38.8	3.2
137	298	83	201	67	20	6.7	27.5	9.2
138	40.3	23	0.06	.15	0	0	9.3	23
139	242	99	224	93	.05	0	15.3	6.3
094								
Missouri	176	94	156	89	9.1	5.1	1.0	0.6
Kansas	28.4	68	10.3	36	0.40	1.4	8.6	3.0
	204	90	166	81	9.5	4.6	9.6	4.7

Table A-9. Missouri Required Emission Reductions - Particulates

AQCR	AQ Measurement Control Value	SIP Emissions (10^3 Tons)	SIP Allowable Emissions (10^3 Tons)	SIP 1975 Estimated Emissions After Controls (10^3 Tons)	Percent Reduction Required Based On 1973 AQ Data	NEDS (1972) Emissions (10^3 Tons)	Allowable Emissions (10^3 Tons)	Emission Tolerance (10^3 Tons)
070 Missouri Illinois	Air Quality Display type model used to show NAAQS attainment in Saint Louis			36.8 52.7 89.5 (1)	82	44 310 354	7.5 52.7 60.2 (2)	0 (2)
137	AQDM type model used to show NAAQS attainment in Kansas City, AQCR 094, which serve as example region for AQCR's 137, 138, 139			N/A	46	64	33	0 (4)
138				N/A	74	25.5	6.6	0 (4)
139				N/A	1+	53	44	0 (4)
094 Missouri Kansas	197 $\mu g/m^3$ Annual Geometric Mean	104	7.4	N/A	85	35.7 42.2 77.9	5.4 6.3 11.7	0 (3)

(1) St. Louis sample Air Quality Maintenance Plan Interim Report, July 1974. Prepared for U.S. EPA

(2) Allowable emissions were proportioned between Missouri and Illinois according to existing emissions. 1975 estimated emissions on an AQCR basis are above those allowed according to 1973 NED'S/SAROAD rollback. The compatability of reference (1) emission inventory and NED'S is not known but the indication is that no regional tolerance for additional emissions exists.

(3) No estimate of 1975 emission in Kansas City (AQCR 094) was available. The 1973 NED'S inventory is somewhat lower than the original SIP inventory, suggesting perhaps some progress on controls. Based on 1973 data and the severity of particulate violations in Kansas City, zero emissions tolerance for particulates is assigned for AQCR 094.

(4) AQCR'S 137, 138, and 139 are assigned zero particulate emission tolerance base solely on current air quality.

Table A-10. Missouri Required Emission Reductions-SO_2

AQCR	SIP: AQ Measurement Control Value	SIP: Emissions (10^3 Tons)	SIP: Allowable Emissions (10^3 Tons)	SIP: 1975 Estimated Emissions After Controls (10^3 Tons)	Percent Reduction Required Based On 1973 AQ Data	NEDS (1972) Emissions (10^3 Tons)	Allowable Emissions (10^3 Tons)	Emission Tolerance (10^3 Tons)
070 Missouri Illinois	[Air Quality Display type model used to show NAAQS attainment in St. Louis.]			889(1) 138 1027	32	514 720 1234	363 509 872	0(2) 0 0
137	[Kansas City was example region for AQCR's 137, 138, 139. AQDM type model used to demonstrate that SO_2 would not exceed standards in AQCR 094]			N/A	N/A	298	N/A	N/A(3)
138				N/A	-68	40	68	28
139				N/A	N/A	242	N/A	N/A(4)
094 Missouri Kansas	[100 (24 hr max) 20 (AG ...]	119	435	N/A	-22	176 28 204	215 34 249	6 39 45(5)

(1) SO_2 data from "St. Louis Sample Air Quality Maintenance Plan" Interim report, July, 1974.

(2) Table A-6 (continued) shows additional SO_2 data for St. Louis other than SAROAD. The 32 is based on the highest station in Missouri. The highest station in Illinois shows annual levels around four percent below standard.

(3) No SO_2 monitors in AQCR 137 according to SAROAD data.

(4) Very low SO_2 levels make rollup calculations unrealistic for AQCR 138.

(5) Rollup in AQCR 094 is proportional according to existing emissions in Kansas and Missouri.

Table A-11 Fuel Combustion Regulations - Missouri

	Existing Sources			New Sources	
	SO_2	Particulates		SO_2	Particulates
070 St. Louis[1] (State Regulations)	2.3 lbs/10^6 Btu (2000x10^6 Btu/hr) Coal must be less than 2.0% sulfur for sources less than 2000x10^6 Btu/hr (Approx 3.3 lbs/10^6 Btu)	Heat Input (I) (106 Btu/hr	Allowed(A) (lbs/10^6 Btu)	Power Plants[2] Oil-0.8 lbs SO_2/10^6 Btu Coal-1.2 lbs SO_2/10^6 Btu Other sources same as existing regulations	Power Plants[2] 0.1 lbs/10^6 Btu Other sources same as existing regulations
		10	0.60		
		10,000	0.18		
		A = 0.891$^{-.174}$			
094 Kansas City[1] (State Regulations) (Also Independence and Springfield)	Based on ambient air criteria, does not relate directly to lbs/10^6 Btu or percent sulfur in fuel[3]	(I) 10^6 Btu/hr	(A) lbs/10^6Btu	Same as Existing except power Plants	Same as Existing except power plants
		10	0.60		
		10,000	0.12		
		A = 1.026 I$^{-.233}$			
Missouri (Other AQCRs)	Ambient air criteria only[3]	Same as for Saint Louis		Same as existing except power plants	Same as existing except power plants

(1) Local regulations are slightly different, State regulations are used for purposes of this report.

(2) FED new source performance standards, 36 FED. Reg. 24867, Dec. 26, 1971.

(3) SO_2 concentration in ambient air not to exceed:

Concentration ($\mu g/m^3$)	Averaging Time	Maximum Allowable
667 (0.25PPM)	1 hour	Once in any 4 days
187 (0.07PPM)	24 hour	Once in any 90 days

Applies only beyond premises of emitter.

APPENDIX B

Tables B-1 and B-2 are the assessment of AQCRs which should be examined for the fuel switching impact on particulate and SO_2 emissions. They also provides an identification of those AQCRs which show little potential for fuel revision or regulation relaxation if ambient air standards are to be attained.

Those AQCRs designated "good" or "marginal" here will be examined in later appendices where an attempt will be made to estimate the emissions resulting from an assumed fuel schedule different from the present, or the emissions which might result if all fuel burning sources emitted up to their "allowables."

The criteria for candidates are (1) the severity and breadth of air quality violations, (2) the tolerance for emissions increased in the AQCR, (3) the fraction of total emissions resulting from fuel combustion, and (4) AQMA designations. It should be noted that an AQCR may not necessarily need relaxation of regulations in order to accomplish fuel switching. Further, a good candidate in Tables B-1 and B-2 may later show little potential for fuel switching after individual sources are examined. Finally it is posssible that an AQCR may have air quality levels below standard at present and may require more strict regulations than currently exist if all fuel burning sources were converted to dirtier fuels, i.e., "average" emission rate now may be below "average" regulations.

Table B-1. Candidacy Assessment for Relaxation of Particulates Regulations/Fuel Switch Potential - Missouri

AQCR	Air Quality		Expected Attainment Date	Total Emissions (10^3 tons)	Any Counties AQMA Designations?	% Emission from Fuel Combustion	Tolerance for Emissions Increase (10^3 tons)	Overall Regional Evaluation
	# Monitors	# Violations						
070								
Missouri	28	10	7/75	44	Yes	57	None	Poor
Illinois	1	1		310		22		
	29	11		354		32		
137	9	2	7/75	64	No	66	None	Poor
138	10	3	7/75	26	NO	39	None	Poor
139	13	3	7/75	53	No	40	None	Poor
094								
Missouri	19	12	7/75	36	No	55	None	Poor
Illinois	14	9		42		15		
	33	21		78		34		

Table B-2. Candidacy Assessment for Relaxation of SO_2 Regulations/Fuel Switch Potential

AQCR	Air Quality: # Stations	Air Quality: # Violations	Expected Attainment Date	Any Counties Proposed AQMA Designations?	Total Emissions 10^3 tons/yr	% Emission From Fuel Combustion	Tolerance for Emissions Increase (10^3 tons)	Overall Regional Evaluation
070	SAROAD	SAROAD						
Missouri	12	0	7/75	No				
Illinois	4	0						
	16	0						
	Others	Others						
Missouri	10	1			514	72		
Illinois	4	1			720	93	0	
					1234	84		Poor
137	0	-	7/75	No	298	83	(a)	Good
138	5	0	7/75	No	40	23	28	Good
139	4	0	7/75	No	242	99	(a)	Good
094								
Missouri	7	0	7/75	No	176	94	6	Good
Kansas	11	0			28	68	39	
	18	0			204	90	45	

(a) Emission Tolerance is not quantifiable in AQCR's 137 and 139

APPENDIX C

This section is a review of individual power plants by AQCR. The intent is to illustrate: (1) current SO_2 and particulate emissions, (2) fuel switching possibilities, and (3) allowed emissions for power plants based on current regulations. The total AQCR emissions resulting from possible fuel switches is then calculated.

Current power plant information used to prepare Table C-1 were obtained from three main sources: (1) Federal Power Commission computerized listings of power plants and their associated fuel use, (2) the National Coal Association "Steam Tables" listing of power plants and fuel use in 1972, and (3) NEDS Emissions data.[1] For those plants listed by the FPC (1 above), the 1973 fuel schedule was assumed, otherwise, fuel use is for 1972. Heat inputs are those based on actual fuel values where known, and average values shown in Table C-3 were used where not known. SO_2 and particulates emissions are those associated with the fuel use shown. In the case of particulates, emissions were calculated using NEDS emissions factors applied to the listed fuel schedule (in both tonnage and $lbs/10^6$ Btu). When a plant was not listed in NEDS, AP 42 emission factors were used to estimate SO_2 and particulate emissions (see Table C-3).

Table(s) C-1 also lists allowable emissions calculated by applying current regulations to the given plant, taken from Table A-12. (Particulate limits are assumed to be based on the entire heat input of the plant. Actual rules may be different when applied to each of several boilers in a power plant or applied on the basis of design capacity rather than actual amount of fuel used.)

Total fuels, emissions, and allowables are summed for each AQCR at the bottom of Table(s) C-1 and are shown again in Tables C-2 for comparison after fuel switch. Plants are switched entirely to coal where possible and to 2.0% sulfur oil if a plant cannot use coal. The fuel switch calculations are intended to show the magnitude of emissions increase accompanying a fuel switch without additional controls. The exact emissions would depend upon actual fuel mix, amount of sulfur in fuels, and degree of emissions controls accompanying a fuel switch.

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[1] NEDS Data Bank 1974

It might be cautioned that AQCR total emissions calculated in the tables of Appendix C (and also Appendix D) may not agree exactly with total emissions represented in Appendix A (Tables A-7, A-8). This is a result of both differing fuel schedules in 1973 compared to previous years and the relative "completeness" of the NEDS data bank. Along the same line, AQCR totals may contain a "mix" of 1972 and 1973 fuel schedules (and resulting emissions). The intent of the listings is not great precision, but rather to show approximate status relative to regulations at present, and to show results of fuel switching where possible.

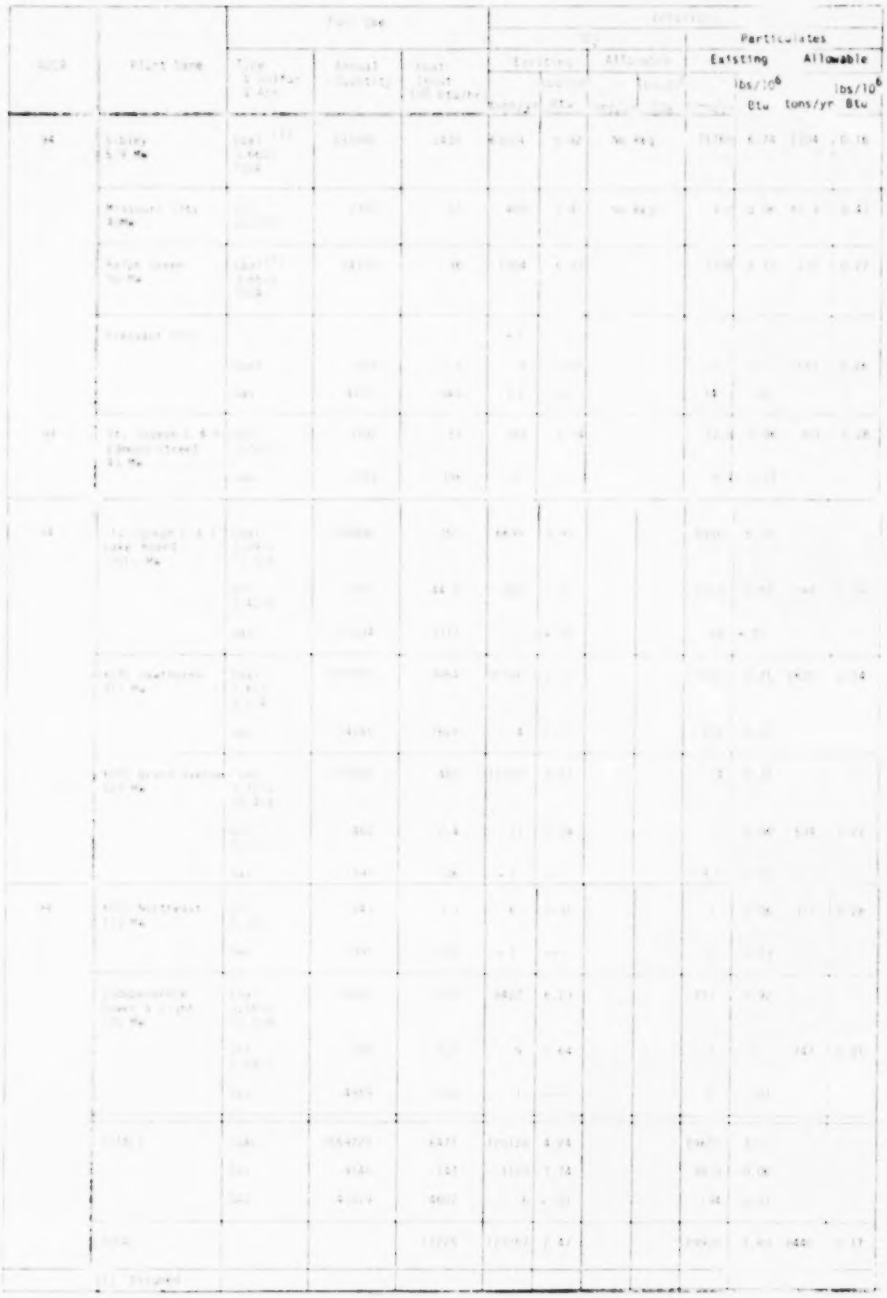
Table C-4 lists power plants under construction or consideration for the near to medium term future. No evaluation of these plants is attempted here since Federal new source performance standards would apply. It is not the purpose of this report to evaluate such standards. Inclusion of new plants is for background information which might have a bearing on other decisions about emission regulations in an AQCR.

Table C-1. Missouri Power Plant Fuel Combustion Point Source Characterization

AQCR	Plant Name	Fuel Use			Emissions							
					SO_2				Particulates			
					Existing		Allowable		Existing		Allowable	
		Type % Sulfur % Ash	Annual (1) Quantity	Heat Input (10^6 Btu/hr)	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu
70	Union Electric Sioux Station 1100 MW	Coal 2.78%S 12.9%A	1590	4050	84605	4.77	40795	2.3	103	0.01	2472	0.24
		Oil 0.3%S	42	7	<1	--			<1	---		
				4057					103			
	Union Electric Ashley Station 70 MW	Oil 2.00%S	26460	424	4108	2.21	4108	2.3	106	0.06	636	0.36
				424					106			
	Union Electric Meramac Plant 923 MW	Coal 1.47%S 11.7%A	1624	4458	46361	2.37	45011	2.3	2470	0.13	4560	0.24
		Oil 1.0%S	252	4	20	1.14			<1	---		
		Gas	109	12.4	<1	---			<1	---		
				44.74					2470			
70	Union Electric Labadie 2417 MW	Coal 3.08%S 10.1%A	4359	11132	256407	5.26	112168	2.3	1429	0.03	9556	0.20
		Oil 0.3%S	2184	35	51	0.33			8.7	0.06		
70	Total	Coal	7573000	19640	387373	4.90			4002	0.05		
		Oil	28938	429	4179	2.22			115	0.06		
		Gas	109	12.4	<1	---			<1	---		
				20081	391552	4.45	202082	2.3	4117	0.05	17224	0.20

(1) Coal - 10^3 Tons
Oil - 10^3 Gallons
Gas - 10^6 Ft^3

Table C-1. Missouri Power Plant Fuel Combustion Point Source Characterization



												Particulates		
												Existing		Allowable
												lbs/10^6 Btu	tons/yr	lbs/10^6 Btu

Table C-1. Missouri Power Plant Fuel Combustion Source Characterization

AQCR	Plant Name	Fuel Use: Type, % Sulfur, % Ash	Annual Quantity	Heat Input (10^6 Btu/hr)	Emissions: SO_2 Existing tons/yr	SO_2 Existing lbs/10^6 Btu	SO_2 Allowable tons/yr	SO_2 Allowable lbs/10^6 Btu	Particulates Existing tons/yr	Particulates Existing lbs/10^6 Btu	Particulates Allowable tons/yr	Particulates Allowable lbs/10^6 Btu
137	University of Missouri Power	Coal	171,000	449	13000	6.61			1050	0.53	693	0.35
	Mexico 19 Mw	Gas	2039	233	<1	---			15	0.05	320	0.40
	Fulton 11.5 Mw	Coal[1] 3% 10%A	21000	52.7	273	1.16			384	1.66	118	0.51
	nominal 14 Mw	Coal[1] 3% 10%A	9000	22.5	117	1.16			165	1.66	56.7	0.57
		Gas	61	7.0	<1	---			<1	---		
	Marshall 30.5 Mw	Coal[1] 3% 10%A	8000	20.1	104	1.16			146	1.65	338	0.44
		Gas	471	104	<1	---			6.8	0.01		
137	Chillicothe Municipal Utility 150 Mw	Coal 3.7% 9.8%A	36000	133	2671	5.41			8.5	0.08	217	0.45
	Central Electric Power 54 Mw	Coal 2.70% 10.7%A	14400	183	1570	4.45			1580	1.97	329	0.41
	Associated Elect. Corporation 470 Mw	Coal 4.92% 14.0%A	1338000	3014	72235	8.51			2401	0.14	3335	0.25
	Missouri Power & Light Jefferson City	Coal 4.0% 12.0%A	8770	23.0	667	5.62			105	1.06	235	0.47
		Gas	550	62.8	<1	---			4	0.01		
	Columbia Water & Light	Coal 3.93% 10.43%A	471,000	1116	43100	5.95			3510	0.72	1462	0.30
		Gas	355	42.6	<1	---			<1	---		
137	Chamerror 40 Mw	Coal[4] 3% 10%A	11000	27.8	403	1.16			587	1.66	164	0.48
	South River 15 Mw	Gas	88	9.8	<1	---			<1	---	---	0.60
	TOTALS	COAL	2120370	5071	162240	7.30			9447	0.43		
		OIL	0	0	0				0			
		GAS	4004	45x					25.8	0.01		
	TOTAL			5530	162240	6.70			9473	0.39	7068	0.29

(1) Coal - tons
(2) Oil - 10^3 gallons
(3) Gas - 10^6 ft^3
(4) Assumed for those plants not listed in NEDS, no particulate control assumed.

Table C-1. Missouri Power Plant Fuel Combustion Point Source Characterization

AQCR	Plant Name	Fuel Use			Emissions								
		Type % Sulfur % Ash	Annual Quantity	Heat Input (10^6 Btu/hr)	SO2				Particulates				
					Existing		Allowable		Existing		Allowable		
					tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu
138	Federated Electric Corp.	Coal 3.48S 10.08A	4,160,000	9498	283000	6.8			4,170	0.10	8757	0.21
139	Empire District Electric Company	Coal 5.23%S 27.3%A	660,000	1508	65570	9.93			361	0.05	2094	0.29
	Springfield Utilities 253 MW	Coal 3.45%S 13.6%A	105,000	300	8185	6.23			1229	0.94	1512	0.29
	KCPEL Montrose Plant 213 MW	Gas	8588	981	.1	.01			6.1	-.01		
		Coal	1,697,000	5036	200016	9.07			1319	0.06	5079	0.23
	TOTAL	COAL	2,462,000	6844	273771				2909			
		GAS	8588	981	.1				6.1			
	TOTAL			7825	273772	8.0			2915	0.09	8685	0.25

Table C-2. AQCR Emissions Comparison with Fuel Switch (Power Plants Only)

AQCR 70

Fuel	Present Use Quantity (1)	10^9 Btu	Gas & Oil to Coal Quantity	10^9 Btu	Gas to Oil Only Quantity	10^9 Btu	
Coal	7573	172048	7593	172502			
Oil	699	3758	625	3411			
Gas	109	109	0	0			
		175913		175913			

	Emissions (Tons /Y)	Emissions (Tons/Y)	Emissions (Tons/Y)	Allowable Emissions (3)
SO_2	391552	392193		202082
Particulate	4117	4116		17224

	$Lbs/10^6$ Btu	$Lbs/10^6$ Btu		$Lbs/10^6$ Btu
SO_2	4.45	4.46		2.3
Particulate	0.05	0.05		0.2

AQCR 94

Fuel	Present Use Quantity	10^9 Btu	Gas & Oil to Coal Quantity	10^9 Btu	Gas to Oil Only Quantity	10^9 Btu	
COAL	2559.7	56686	4236	93810	2559.7	56686	
OIL	218	1260	136	806*	3823	22592	
GAS	40319	40357	3715	3715*	19035	19053	
		98331		98331		98331	

	Emissions (Tons /Y)	Emissions (Tons/Y)	Emissions (Tons/Y)	Allowable Emissions (3)
SO_2	121257	199475	139825	NO REG.
Particulate	07920	14082	9561	8469

	$Lbs/10^6$ BTU			$Lbs/10^6$ BTU
SO_2	2.47	4.06	2.64	NO REG.
Particulate	3.83	3.20	1.64	0.37

* No switching indicated because there are some plants with no coal burning capabilities

(1) Coal - 10^3 tons
Oil - 10^3 BBLS
Gas - 10^6 ft^3

Table C-2. AQCR Emissions Comparison with Fuel Switch (Power Plants Only)

AQCR 137

Fuel	Present Use Quantity	10^9 Btu	Gas & Oil to Coal Quantity	10^9 Btu	
COAL	2120.4	44422	2210	46329	
GAS	4004	4021	2125	2134	
				50463	
	Emissions (Tons/Yr)		Emissions (Tons/Yr)		
SO_2	142241		151[illegible]		NO REG.
Particulate	9471		9961		9969
	Lbs/10^6 BTU				Lbs/10^6 BTU
SO_2	6.70		6.38		NO REG.
Particulate	0.44		0.41		0.39

AQCR 138

Fuel	Present Use Quantity	10^9 Btu	Gas & Oil to Coal Quantity	10^9 Btu	
COAL	4161	87381			
		87381			
	Emissions (Tons/Yr)		Emissions (Tons/Yr)		
SO_2	263,000				NO REG.
Particulate	4,100				4793
	Lbs/10^6 Btu				Lbs/10^6 Btu
SO_2	6.0				NO REG.
Particulate	.10				0.21

AQCR 139

Fuel	Present Use Quantity	10^9 Btu	Gas & Oil to Coal Quantity	10^9 Btu	
COAL	2842	59651	3151	66147	
GAS	4588	4744	0	0	
		64547		66547	
	Emissions (Tons/Yr)		Emissions (Tons/Yr)		
SO_2	223772		313[illegible]		NO REG.
Particulate	2410		3326		8685
	Lbs/10^6 Btu				Lbs/10^6 Btu
SO_2	5.0		5.13		NO REG.
Particulate	0.04		0.10		0.25

Table C-3. AP-42 Power Generation Emission Factors

Fuel	Particulates Lbs/Ton	Particulates Lbs/10^6 Btu	SO_2 Lbs/Ton	SO_2 Lbs/10^6 Btu	Hydrocarbons Lbs/Ton	Hydrocarbons Lbs/10^6 Btu	NO_x (as NO_2) Lbs/Ton	NO_x (as NO_2) Lbs/10^6 Btu
Coal[1] (Bit.)								
General } 10% A	160	7.4			0.3	0.013	18	0.78
Wetbottom } 10% A	130	7.0					30	1.3
Cyclone } 10% A	20	0.9					55	2.4
1% S	Same	Same	38	1.65	0.3	0.013	Same	Same
2% S	as	as	76	3.3			as	as
3% S	Above	Above	114	5.0			Above	Above
Oil[2]	Lb/10^3 Gal		Lb/10^3 Gal		Lb/10^3 Gal		Lb/10^3 Gal	
0.5% S	8	0.058	79	0.56	2	.014	105	0.75
1.0% S	8	.058	157	1.12	2	.014	105	0.75
2.0% S	8	.058	314	2.24	2	.014	105	0.75
Gas[3]	Lb/10^6Ft^3		Lb/10^6Ft^3		Lb/10^6Ft^3		Lb/10^6Ft^3	
(.3 lbs S/ 10^6 Ft^3)	15	.015	0.57	.00057	1	.001	600	0.60

(1) Coal 23 x 10^6 Btu/Ton

(2) Oil 140 x 10^3 Btu/Gal

(3) Gas 1000 Btu/Ft^3

Table C-4. Missouri Proposed Power Plant Characterization

AQCR	Plant Name	Fuel Use: Type, % Sulfur, % Ash	Fuel Use: Annual Quantity 10^3 Tons	Fuel Use: Heat Input (10^6 Btu/hr)	EMISSIONS: SO_2: Existing tons/yr	EMISSIONS: SO_2: Existing lbs/10^6Btu	EMISSIONS: SO_2: Estimated Allowable tons/yr	EMISSIONS: SO_2: Estimated Allowable lbs/10^6Btu	EMISSIONS: Particulates: Existing	EMISSIONS: Particulates: Estimated Allowable tons/yr	EMISSIONS: Particulates: Estimated Allowable lbs/10^6Btu
138	New Madrid #1 #2 (600MW)	Coal	1942 (1)	6000	Unknown		31500	1.2		2630	0.10
070	Rush Island #1 #2 (555MW)	Coal	1797 (1)	5550	Unknown		29000	1.2		2430	0.10
139	Southwest (Springfield) 194MW	Coal	628 (1)	1940	Unknown		10200	1.2		850	0.10

(1) Estimated from MW rating @ 85% capacity, 30% generating efficiency, and 23 X 10^6 Btu/Ton for coal

APPENDIX D

The Tables D-1 in this appendix list individual industrial/commercial/institutional sources of particulates and SO_2 emissions which might show fuel switching potential. The sources are from a NEDS rank order emissions listing. Tables D-1 account for at least 95% of a total emissions (both fuel and non-fuel sources) in the AQCR, since not all industrial sources could be listed in this report. It should be cautioned that the percent emissions accounted for is different than the "% of fuel use accounted for." It is possible that several potential fuel switch sources could be overlooked by the cutoff point on the emissions (i.e., a reasonable sized natural gas used may emit below our cutoff point in the NEDS rank order list).

Fuel switch emissions calculations were not made for industrial sources, since no information was available for feasibility of <u>any</u> fuel switching. Current fuels and emissions are listed along with the emissions which would be allowed by existing regulations.

Table D-1. Missouri Industrial-Commercial Fuel Combustion Point Source Characterization

AQCR	Plant Name	Fuel Use: Type, % Sulfur, % Ash	Fuel Use: Annual Quantity [1]	Fuel Use: Heat Input (10^6 Btu/hr)	Emissions: SO_2 Existing tons/yr	SO_2 Existing lbs/10^6 Btu	SO_2 Allowable tons/yr	SO_2 Allowable lbs/10^6 Btu	Particulates Existing tons/yr	Particulates Existing lbs/10^6 Btu	Particulates Allowable tons/yr	Particulates Allowable lbs/10^6 Btu
70	V. A. Hospital	Oil 1.9%S	154	2.7	23	1.94	NO REG.		2	0.17	6	0.60
		Gas	34	4.0 6.7	<1	---			<1	---		
	Chrysler Assembly	Gas	800	91.3	<1	---	NO REG.		7	0.02	1.58	0.45
	Emerson Electric	Gas	216	24.7	<1	---	NO REG.		<1	---	54	.5
	Mc Donald Douglas	Oil 0.3%S	10	0.16	<1	---	NO REG.		<1	---	161	0.46
		Gas	746	91.8 92.0	<1	---			7	0.02		
	National Lead Titanium	Coal 3.3%S 9.6%A	99780	251	6250	5.68	7263[2]	3.3	650	0.59		
		Oil 0.7%S	3081	53.5	170	0.73			2	0.01	456	0.35
		Gas Gas(*)	1374 580	165 33.1 503	<1 <1	--- ---			<1 <1 442	--- ---		
70	Anheuser Busch	Coal 3.6%S 10.6%A	31230	78.4	2139	6.23	5100[2]	3.3	245	0.71		
		Oil 1.4%S	93	1.49	14	2.15			1	0.15	519	0.37
		Gas	2380	273 353	<1	---			21	0.02		
	GMC Chassis Plant	Coal 2.92%S 10.2%A	26050	68.4	1445	4.82	2703[2]	3.3	28	0.09	128	0.41
		Gas	995	119 187	<1	---			<1	---		
	Mallinckrodt	Gas	1250	143	<1	---	NO REG.		12	0.02	258	0.43
	Monsanto	Coal 2.8%S 8.2%A	138760	364	7378	4.63	6056	3.3	4187	2.63	683	0.36
		Gas	486	55 419	<1	---			5	0.02		
70	Washington University	Coal 3.25%S 9.7%A	7510	19.7	461	5.37	1046	3.3	355	4.11	185	0.48
		Gas	440	52.7 72.4	<1	---			3	0.01		
	P.P.G. Glass	Coal 3.0%S 10.0%A	18,800	47.2	1070	5.18	867	3.3	18.8	0.91	103	0.50
		Gas	109	12.1 60.3	<1	---			<1	---		
	U. S. Steel	Oil 2.0%S	1216	20.7	190	2.10	NO REG.		14	0.15	181	0.86
		Gas	682	75.1	<1	---			8	0.02		
	TOTAL	COAL	322130	829	18745	5.16		3.3	8660	2.39		
		OIL	4554	78.6	397	1.15			19	0.06		
		GAS	10081	1141	---	---			61	0.02		
	TOTAL			2049	19142	2.13	23035	≈ 4	8740	0.97	2820	0.31

(1) Coal - tons
Oil - 10^3 gallons
Gas - 10^6 ft^3
(2) Assumes all coal used.
(*) Coke gas prod. 500 Btu/SCF

Table D-1. Missouri Industrial-Commercial Fuel Combustion Point Source Characterization

AQCR	Plant Name	Fuel Use			Emissions							
					SO_2				Particulates			
					Existing		Allowable		Existing		Allowable	
		Type % Sulfur % Ash	Annual (1) Quantity	Heat Input (10^6 Btu/hr)	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu
94	AM Oil	Oil 2.49%S	52600	901	3115	0.79			488	0.12		
		Gas	3004	343	<1	---			26	0.02	1002	0.16
		Gas * 1.75%S	1110	342	279	0.19			9	0.01		
		Gas *	5449	653	---	---	NO REG.		---	---		
	American Paving	Gas	102	11.6	<1	---			<1	---	---	0.56
	ARMCO Steel	Oil 1.5%S	1610	25.4	189	1.70			18	0.16	51.8	0.46
		Gas	11	1.3	<1	---			<1	---		
	Bendix Plant AEC	Oil 2.0%S	1360	23.3	214	2.10			16	0.16	311	0.27
		Gas	2281	260	<1	---			21	0.02		
94	KCPL	Oil 2.49%S	15300	262	3000	2.61			176	0.15	473	0.24
		Gas	876	105	<1	---			8	0.02		
		Gas * 1.75%S	325	100	270	0.62			2	.005		
	Richards Gebaur AFB	Oil 1.25%S	1818	30.1	159	1.21			12	0.09	93.3	0.40
		Gas	155	17.7	<1	---			1	0.01		
	CPC International	Oil 1.5%S	1050	18.1	2550	32.3*			270	3.4	374.2	0.26
		Gas	2710	309	17	0.01			544	0.40		
	TOTALS	COAL	0	0	0	0	NO REG.		0			
		OIL	73859	1262	9235	1.67			980	0.18		
		GAS	16025	2133	566	0.06			611	0.07		
	TOTAL			3395	9801	0.66			1591	0.11	2305	0.16

(1) Coal - tons
(2) Oil - 1000 gallons
(3) Gas - 10^6 ft^3
* Process Gas

Table D-1. Missouri Industrial-Commercial Fuel Combustion Point Source Characteristization

AQCR	Plant Name	Fuel Use			Emissions							
					SO_2				Particulates			
					Existing		Allowable		Existing		Allowable	
		Type % Sulfur % Ash	Annual Quantity (1)	Heat Input (10^6 Btu/hr)	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu	tons/yr	lbs/10^6 Btu
137	Central Electric	Coal 2.70%S 10.7%A	186000	494	9640	4.46			402	0.19	741	0.35
	Hercules Inc.	Coal 1.7%S 7.1%A	174900	459	4700	2.34			1967	0.98	3789	0.25
		Gas	24874	2981	5640	0.43			2367	0.18		
	TOTALS	COAL	360900	953	14340	1.44	NO REG.		2369	0.57		
		OIL	0	0	0	0			0	0		
		GAS	24874	2981	5640	0.43			2367	0.18		
	TOTAL			3934	19980	1.36			4736	0.27	4530	0.26
138	Laclerre-Sawyer	Coal 3%* 10%A*	11,300	28.4	R	0.06			155	1.25	70.7	0.57
	AMAX Lead Co.	Coal 1.0%S 6.0%A	3000	7.88	57	1.65			<1	---	---	0.71
	TOTAL	COAL	11,400	36.3	65	0.41	NO REG.		155	1.25	70.7	0.44
139	Springday Co.	Oil 2.3%S	250	4.3	45	2.39			3	0.16	88.5	0.53
		Gas	363	41.4	<1	---			3	0.02		
	Smith Flooring	Wood	1200 Ton		<1	---			16	---	---	---
	Atlas Powder Company	Oil 0.4%S	6	0.10	<1	---	---		<1	---	486	0.36
		Gas	3431	387	<1	---			27	0.02		
	Fet Incorporated	Oil 0.18%S	60	0.99	<1	---	---		<1	---	59.0	0.59
		Gas	192	21.9	<1	---			2	0.02		
	TOTAL	OIL	316	5.4	45	1.9	NO REG.		3	0.13		
		GAS	3893	453	---	---			48	0.02		
	TOTAL			458.4	45	0.02			51	0.03	634	0.32

(1) Coal - tons
Oil - 1000 gallons
Gas - 10^6 ft^3

Table D-2. Major Industrial Fuel and Emissions Summary - Missouri

AQCR	Fuel Acounted For			SO_2		Particulates	
	Coal Tons	10^3 Gal. Oil	10^6 ft^3 Gas	Existing Emissions (Tons)	Allowed Emissions (Tons)	Existing (Tons)	Allowed (Tons)
70	322.1	108	10081	19142	23035	8740	2820
94	0	1759	16025	9801	No Reg	1591	2305
137	362.9	0	24874	19980	No Reg	4736	4530
138	11.6	0	0	65	No Reg	155	70.7
139	0	7.5	3893	45	No Reg	51	634
STATE	707	1875	54873				

APPENDIX E

Table E-1 shows area source fuel use for the State of Missouri by AQCR. The approximate energy values are compared for each fuel along with the percent of overall energy derived from each fuel. Data are those in NEDS as of November 1, 1974. State area source totals are calculated and the percent of energy derived from each fuel shown.

Area source fuel use is then compared to total fuel use in Missouri. The bottom row entitled "all fuels, all sources" may not match totals from Appendices A, C, and D exactly, since neither the NEDS or individual appendix totals are all-inclusive.

A Table E-2 shows area source fuel use and SO_2 and particulate emissions in St. Louis (AQCR 070). Also indicated are SO_2 emissions when the 2% sulfur in coal regulation is met.

Table E-1. Missouri Area Source Fuel Use

AQCR	Coal		Oil		Gas		Total
	Tons	10^9 Btu	10^3 bbl	10^9 Btu	10^3 ft^3	10^9 Btu	10^{12} Btu
Missouri							
070							
Missouri	220820	5079	2519	14812	113570	113570	
Illinois	139760	3214	2436	14324	39440	39440	
TOTAL	360580	8293	4955	29135	153010	153010	190.4
094							
Missouri	2280	52	453	2664	68500	68500	71.2
Kansas	74470	1713	283	1664	40790	40790	44.2
TOTAL	76750	1765	736	43.28	109290	109290	115.4
137	405310	9322	1587	9332	54220	54220	72.9
138	158530	3646	850	4998	33130	33130	41.8
139	102470	2357	1654	9726	73300	73300	85.4
AREA SOURCE AQCR TOTAL	1,103,640	25,383	9782	57519	422,950	422,950	501.6
PERCENT		5.1%		11.5%		84.3%	100%
STATE TOTAL (Missouri Only)	889,580	20,460	7044	41419	354,530	345,530	

Table E-2. AQCR 070 Area Source Fuel Use - Missouri Portion (St. Louis)

	FUEL		APPROXIMATE EMISSIONS	
	Amount	10^9 BTU	SO_2 tons/Yr	Particulates tons/Yr
Current Coal Used 2.8%S	221_6 $X10^6$ tons	5080	12400	18000
(Coal AT regulation (2.0%S)	$221X10^6$tons	5080	8860	18000
OIL	$106X10^6$gal	14800	7000	500
GAS	$114X10^9Ft^3$	114000	---	850
WOOD	9800 Tons	113	---	N/A
TOTALS (Current)		133993	1980	21180

APPENDIX F

The Tables F-1 and F-2 illustrates the effect on emissions of particulates and SO_2 when power plant and industrial fuel burning sources listed in Appendices C and D are allowed to emit up to the amounts that existing regulations would allow. It is assumed that heat input remains the same, and existing regulations are applied to gross heat input for each power plant and industrial source. The column in Table F-1 labeled "Allowable Total Emissions" is the tonnage from Tables A-9 and A-10 which the region can tolerate while still not violating ambient air quality standards. In Table F-2 (SO_2 Evaluation) the analogous column indicates the ratio of emissions resulting when all sources are emitting at regulations to emissions at present.

Area fuel burning sources are assumed to remain unchanged, except in AQCR 070 since SO_2 and particulate regulations generally do not apply to these sources outside St. Louis. Non-fuel emission estimates from Tables A-7 and A-8 are included in the balance. Since the degree of control which will be achieved on non-fuel particulate sources was not known for this report, the particulate totals serve mainly to show magnitudes relative to tonnage allowed by air quality considerations. For SO_2 the non-fuel estimate would, in many AQCR's, remain about the same due to lack of other SO_2 regulations (except for smelters). Thus the SO_2 "ratio" is not too far from that which would be possible under existent regulations.

A regional approach is implicitly assumed to have some validity in this exercise, so that any conclusions from the numbers in Tables F-1 and F-2 will have to be temperated for AQCR's with widely dispersed emissions.

Lastly, it is emphasized that these tables are hypothetical in that no fuel mix may exist to allow all sources to emit exactly at regulation levels. The calculations do give some insight into adequacy of existing regulations for allowing air quality standards to be achieved if a fuel schedule different from the one at present were in effect.

A Table F-3 is included in this appendix to summarize gross consumption and production of fossil fuels in Missouri.

Table F-1. Missouri Particulate Regulation Evaluation

AQCR	10^{12} Btu	Current Emissions Tons/yr	Regulations lbs/10^6 Btu	Emissions with All Sources Emitting at Reg's	Estimate Allowable Emissions in AQCR tons/yr
70 (Missouri Only)					
Power Plants	176	4117	.20-.36	17224	
Industry	17.9	8740	.35-.60	2820	
Area Sources	190	21180	N/A	21180*	
		34037		41224	
Non-Fuel-		18300		18300 Uncontrolled	
Total		52337		59524	Missouri - 7500 Total AQCR - 60,000
137					
Power Plants	48.4	9473	.25-.57	7068	
Industry	34.5	4736	.25-.35	4530	
Area Sources	73	28800		28800	
		43009		40398	
Non-Fuel		21800		21800 Uncontrolled	
Total		64809		62198	33000
138					
Power Plants	83.2	4170	.21	8757	
Industry	0.3	155	.57-.71	71	
Area Sources	42	9900		9900	
		14225		18728	
Non-Fuel		15600		15600	
Total		29825		34328	6600

Table F-1. Missouri Particulate Regulation Evaluation

AQCR	10^{12} Btu	Current Emissions Tons/yr	Regulations lbs/10^6 Btu	Emissions with All Sources Emitting at Reg's	Estimate Attainable Emissions in AQCR tons/yr
139					
Power Plants	66.5	2915	.23-.29	8685	
Industry	4.0	51	.36-.84	634	
Area Sources	85	19600		19600	
		22566		28919	
Non-Fuel		32000		32000	
Total		54566		60919	44000
94 (Missouri Only)					
Power Plants	98.3	89920	.14-.43	8440	
Industry	29.7	1591	.16-0.60	2305	
Area Sources	71	1100	N.A	1100	
		92611		11855	
Non-Fuel		16100		16100 Uncontrolled	5400
Total		108711		27955	
094 (Kansas Only)					
Power Plants	23.8	800	~ 0.2	2455	
Industry	1.95	51	. 2-. 5	390	
Area Sources	44	5800	N/A	5800	
		6651		8645	
Non-Fuel		35900		35900	
Total		24,551		44,545	6300

Table F-2. Missouri SO_2 Regulation Evaluation

AQCR	$\times 10^{12}$ Btu	Current Emissions tons/year	Reg's. lbs/10^6 Btu	Emissions with All Sources Emitting at Reg's	Estimated Allowable Emissions for AQCR	Ratio of Emissions at Regulations to Current Emissions
70 (Missouri Only)					(Missouri Only)	
Power Plants	176	391552	2.3	202082		
Industry	17.9	19142	3.3	12376		
Area Sources	190	19800	3.3	16000		
		430494		230458		
Non-fuel	0	144000		144000		
Total Missouri Total AQCR		574494 -		364458 -	363,000 872,000	0.63
137						
Power Plants	48.4	162240				
Industry	34.5	19980		NO REG.	N/A	—
Area Sources	73	27500				
		209720				
Non-Fuel		50700				
Total		260420				
138						
Power Plants	83.2	283000				
Industry	0.3	65		NO REG.		—
Area Sources	42	9300				
		292365				
Non-fuel		31000			68,000	
Total		323365				

Table F-2. Missouri SO_2 Regulation Evaluation

AQCR	10^{12} Btu	Current Emissions tons/year	Reg's lbs/10^6 Btu	Emissions with All Sources Emitting at Reg's	Estimated Allowable Emissions for AQCR	Ratio of Emissions at Regulations to Current Emissions
139						
Power Plants	68.5	273772		NO REG.	N/A	—
Industry	4.0	45				
Area Sources	85	15300				
		289117				
Non-Fuel		2400				
Total		291517				
94 Missouri Only						
Power Plants	98.3	121257		NO REG.		
Industry	29.7	9801				
Area Sources	71	1000				
		132058				
Non-Fuel		10600				
Total		142658			215,000	—
094 (Kansas Only)						
Power Plants	23.8	13578	3.0	35648		
Industry	1.95	384		3200		
Area Sources	44	8600		8600		
		22562		47448		
Non-Fuel		9090		9090		
Total		31,652		56538	34000	0.91

Table F-3. Missouri Fossil Fuel Summary

FUEL	PRODUCTION	CONSUMPTION
Coal	4.55×10^6 Tons	15.24×10^6 Tons
Oil	0.06×10^6 BBL	109.7×10^6 BBL
Gas	$.009 \times 10^9$ Ft^3	433×10^9 Ft^3

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